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RAMARIA SUBGENERA RAMARIA AND LAETICOLORA IN YUNNAN

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Abstract Three taxa of *Ramaria* subgenus *Ramaria*, and 18 of subg. *Laeticolora* are reported from Yunnan Province. Of these 13 are considered new to science. Only one taxon (*R. formosa*) is considered of widespread distribution, the others being known olny from the Indo-Asian subcontinent. Wide distribution patterns, based on phenetic similarity, seem to be at the infraspecific to species complex level, but only rarely contaxic. New taxa are as follows: subg. *Ramaria*; *R. eryuanensis*; subg. *Laeticolora*; *R. brunneipes*, *R. distinctissima*, *R. ephemeroderma*, *R. hilaris*, *R. laeviformosoides*, *R. linearioides*, *R. linearis*, *R. nanispora*, *R. rubri-attenuipes*, *R. sino-conjunctipes*, *R. rubricarnata* var. *laeta*, *R. botrytoides* var. *microspora*, and *R. neoformosa* var. *sinensis*. Keys to Yunnan taxa of *Ramaria* subgenera *Ramaria* and *Laeticolora* are furnished.
Key words subg. Ramaria; Subg. Laeticolora; Yunnan

Following initial reports of some taxa of *Ramaria* from central Yunnan (Petersen and Zang, 1986; Petersen, 1988a), a subsequent opportunity to collect such fungi came in 1986, when the authors sampled the mycoflora in the vicinity of Lijiang in northern Yunnan. Dominated by *Pinus* forests at lower elevations, *Picea*, *Abies*, and *Betula* are prevalent at higher altitudes. Collecting was done from 2500—3500 m.

Much of the original forest of the area has been cut many times, and presents only immature *Pinus* with little understory. The higher *Picea-Abies* forest, conversely, is lush, with much understory and ground cover, including *Sinoarundinaria*. This forest is ideal for growth and fruiting of macrofungi, including the Gomphaceae, to which *Ramaria* belongs.

It must be stated, however, that the best variety of species was to be found in the local markets. The minority peoples of the area use *Ramaria* fruitbodies in their cooking, so such fungi (as well as many Agaricales) are gathered in the

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forests and sold in the markets. Collectors are understandably vague in reporting locations and habitats, so these are presented only briefly below.

With a growing number of documented taxa known from Yunnan, it is becoming possible to see emergent distribution patterns of taxa and some examples of phenetic similarity to taxa occurring elsewhere. While allusions to such points are made below under appropriate taxa, a more thorough discussion will be offered in a future paper. Undoubtedly, many additional taxa will be added to those discussed below as collecting continues, with this paper offering only the first glimpse of the flora.

In the text below the following abbreviations are used: FCL = ferric chloride in water; CRE = 1-cresol in water; GUA = guaiac tincture; PYR = pyrogallic acid in water; PHN = phenol in water; ANO = aniline oil mixed with water; ANW = alpha naphthol in water; KOH = potassium hydroxide in water; NOH = ammonium hydroxide in water; SYR = syringaldazine in ethanol; TXR = 1-tyrosine in water; IKI = Melzer's reagent. Recipes for these reagents may be found in Marr and Stuntz (1973) and Marr et al. (1986) Colors in quotation marks are from Ridgway (1912).

Specimens were documented as follows: 1) all specimens were dried over warm air using a Durex food drier; 2) uotes on colors, stature, habitat, location, macrochemical reactions, etc. were entered into bound notebooks, with corresponding field numbers assigned to specimens, notes and photos; 3) 35 mm color transparencies (photographs) were taken of virtually all fruitbodies against a standard gray card. Notes and photos have been stored at TENN. and specimens have been deposited at TENN and HKAS.

KEY TO SPECIES OF SUBG. RAMARIA FROM YUNNAN

1. Apices deep red when young or fresh; spores 8.6—11.2×4.3—5.4μm(L^m = 6.6μm) ..... **R. hemirubella**
1. Apices pallid cinnamon to avellaneous, but not red 2
   2. Spores 10.8—13×4—5 μm (L^m = 11.88 μm); branches and apices pallid cinnamon to pastel rosy tan ..... **R. eryuanensis**
   2. Spores 13—16.6×5—5.6 μm (L^m = 15.06μm); apices light avellaneous to avellaneous ..... **Ramaria affin. strasseri**

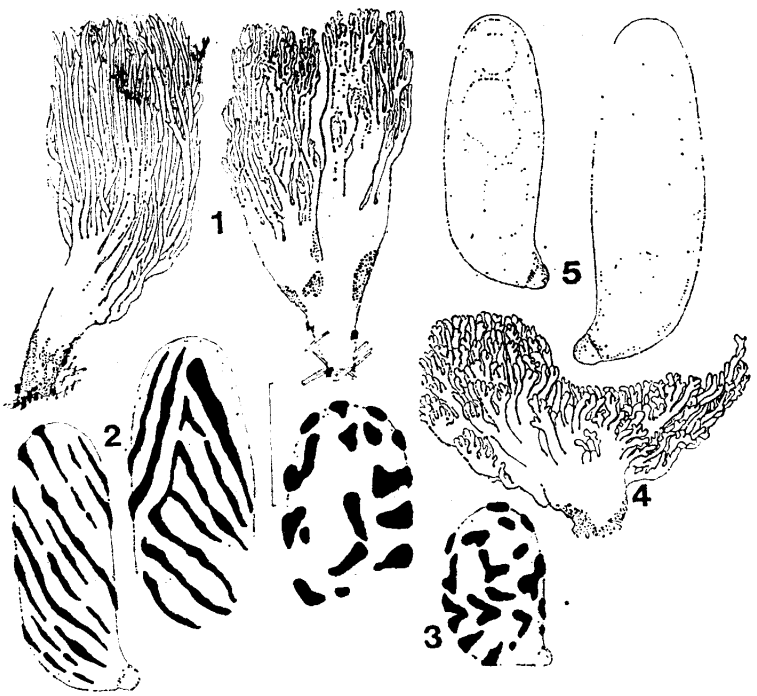
1. 洱源丛枝瑚

Ramaria eryuanensis Petersen et Zang, sp. nov. Figs. 1, 2

Basidiocarpi multiramosi, ad 12×8 cm, obovati. Basi ad 7×5 cm, crassi, singulati, cum ramuli abortivi; contusi brunnescenti; caro albo, nongelatinoso. Rami et ramuli cremei pallide ad pallide fusco-incarnati. Apices tenui, cum ramuli concolori. Hyphae contextualis fibulatae, crassitunicatae. Basidia 68—76×9—10 μm, clavata, fibulata. Sporae 10.8—13.0×4.0—5.0μm, tenui-ellipsoidae ad

boletoideae, cum ornati striati.

Fruitbodies (Fig. 1) up to 12 × 8 cm, obovate in outline. Stipe up to 7 X 5 cm, massive, rounded at base, sometimes rooting, smooth, smewhat flattened, often with a few abortive stumps high on stipe, somewhat flattened laterally, white at base, sometime suffused pinkish at base, off-white above, easily brunnescent on all surfaces where handled or rubbed; flesh white, solid, not gelatinous or slippery, sometimes slowly sordid grey where cut. Major branches 2 — 4, stout, short, more or less terete, off-white ("pale ochraceous buff," "pale pinkish cinnamon"). Branches in 3 — 5 ranks, short, elongating reluctantly, crowded, more or less terete, pallid rosy beige ("pinkish buff"), easily brunnescent ("Verona brown"); fleshoff-white ("pale cinnamon pink"), fibrous; internodes short, hardly diminishing above; axils narrowly rounded throughout. Apices digitate to awl-shaped, long, crowded, pastel rosy tan ("light pinkish cinnamon," "light ochraceous cinnamon"), easily brunnescent. Odor faintly fragrant; taste negligible to faintly fabaceous.



Figs. *Ramaria* fruitbodies and spores. 1, 2. ***Ramaria eryuanensis***. 1. Fruitbody. 2. Spores, TENN 47299. 3. ***R. botrytoides*** var. ***microspora*** spores, TENN 47297. 4, 5. ***R. brunnescens***. 4. Eruitbody. 5. spores, TENN 47303, Standard bar = 5 μm for spores.

Macrochemical reactions: SYR = slowly positive, sometimes on rind only; IKI, FCL = positive; ANO, GUA, PHN, PYR, KOH, NOH, CRE = negative to equivocal; ANW = negative.

Stipe tramal hyphae 3—11 μm diam, hyaline, thick-walled (wall up to 1 μm thick), clamped, gnarled, freely branched, interwoven; ampulliform inflations as clamps or asymmetrical lobes, not unusually thick-walled, with extensive stalactitiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 2—8 μm diam, hyalie, thick-walled (wall up to 1 μm thick), straight, occasionally branched, parallel, not agglutinated or adherent; ampulliform clamps up to 15 μm broad, not unusually thick-walled, asymmetrical, unornamented; gloeoplerous hyphae not observed. Subhymenium extensive; hyphae 2—3 μm diam, very tightlz interwoven, clamped. Hymenium thickening; basidia 68—75×9—10μm, clavate, clamped; contents densely granular; sterigmata 4, stout, straight.

Spores (Fig. 2) 10.8—13.0×4.0—5.0μm (E = 2.31—3.00; E^m = 2.65; L^m = 11.88 μm), subboletoid to narrowly ellipsoid, smooth in profile; contents homogeneous and subrefringent or with 1-several refringent, ill-defined inclusions; wall up to 0.2μm thick; hilar appendix prominent, with a throat; ornamentation of coarse striae, arranged in abaxial-distal to adaxial-proximal orientation.

Commentary: Fruitbody stature is typical of subg. *Ramaria*, with massive stipe, abortive branchlets and short branching system. Because of this, supportive characters assume higher significance. In the subgenus, color of upper branches and apices, for example, is usually in red, purple or avellaneous shades, so the pallid cinnamon colors of the specimens cited below is somewhat unique. Only *R. secunda* (Berk. et Curt.) Corner *sensu* Petersen exhibits this coloration. Stipe flesh amyloidity has not been ascertained for that species, and spores are almost identical to those of the Chinese material (for an isotype at FH; 10.4—12.6×4.1—5.2μm; E^m = 2.35; L^m = 11.19μm). But our concept of *R. secunda* includes fruitbodies with modest, short stipes and well-developed branch systems, unlike the Chinese specimens, and *R. secunda* fruitbodies are not noticeably brunnescent.

Berkeley described fruitbodies of *Clavaria secunda* as "pale yellow," presumably on the advice of Curtis, who sent him the dried specimen. We have never seen such colors in this subgenus (except as stains on stipe surfaces), but in all other characteristics, the FH isotype specimen is matched by collections of a taxon from the southern Appalachian Mountains, leading to my concept of the species. Only the pallid cinnamon color differs from the type description and specimen. Thus I must cite the taxon as *sensu* Petersen, for perhaps pale yellow fruitbodies will yet be found.

Wu (1986) may have treated this as *R. rubrievanescens*, especially in light of the pallid pinkish shades which sometimes suffused the stipe base. She gave spore dimensions as 10—12.3×3—5.4 μm. Petersen has found no sign of pink coloration in the apices of *R. eryuanensis*, however, a diagnostic character for *R. rubrievanescens*,

Also quite similar is Marr and Stuntz's (1973) concept of *R. strasseri*. Stature and color is close, and spores are rather similar as well. Unfortunately, having examined several authentic specimens of *R. strasseri*, including co-types, We conclude that Marr and Stuntz's concept of that taxon was incorrect, as pointed out elsewhere (Petersen, 1986). If their concept of *R. strasseri* is contaxic with *R. eryuanensis*, it will have to be called by this name.

Fruitbodies of this species were among the most popular in the local markets of northern Yunnan. Fruitbodies of similar species are preferred for eating in western North America as well, especially in the spring. The Yunnan material reportedly fruited under *Pinus*.

Specimen TENN 47194 exhibited almost universally weakly positive macrochemical reaction, while the other specimens were inert except for IKI, SYR, and FCL.

Specimens examined: Yunnan, Lijiang Pref., Lijiang market, 30. viii. 86, no. 47306 (TENN, HKAS 20044); Lijiang marker, 2. ix. 86, no. 47299 (holotype, TENN; isotype, HKAS 20042); Er Yuan Pref., San Ying village market, 27. viii. 86, no. 47194 (TENN).

2. 淡红丛枝瑚

Ramaria hemirubella Petersen et Zang. Acta Bot. Yunnan. 1986. 8: 285.

Fruitbodies up to 14× 8 cm, broadly fusiform to obpyriform in outline. Stipe up to 5 × 3 cm, single, falsely fasciculate, to compound-connate, tapering to rounded base, smooth, with a few aborted fruitbodies, off-white with a hint of pink upward, in age fleshy buff ("vinaceous cinnamon"), slowly easily brown to red-brown ("Hay's russet") where handled or chaffed, sometimes staining lemon yellow ("pinard yellow") where handled; flesh solid, ooff-white, in age suffused flesh color("vinaceous cinnamon"), moist but not gelatinous or slippery, drying soft, light in weight, easily penetrated. Major branches several, more or less terete, ascending. Branches in 3 — 7 ranks, linear-ascending, of two types: 1) typical, terete, pallid ochre, sometimes with hint of flesh upward ("pinkish buff," "cream buff," "pale cinnamon pink," "cinnamon buff"); internodes diminishing gradually upward; apices shortdigitate, suffused rose-pink in apical centimeter("coral pink"), deep red apically ("Pompeian red," "madder brown, "Corinthian red"), becoming reddish tan in age ("Mikado brown"); and 2) pistillariform, grossly inflated, longitudinally rugose, ruddy ("terra cotta," "vinaceous rufous"). Odor weakly fragrant; taste negligible.

Macrochemical reactions; SYR = positive on stipe base; IKI = positive; FCL = weakly positive; ANO, ANW, PHN, PYR, GUA = negative.

Stipe tramal hyphae 4 —12 μm diam, hyaline, conspicuously clamped, thin to

thick-walled(wall up to 0.5 μm thick), easily broken, interwoven, not agglutinated or adherent; ampulliform clamps up to 15 μm broad, thick-walled (wall up to 1 μm thick), with conspicuous stalactitiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 4—18 μm diam, hyaline, thick-walled (wall up to 1 μm thick locally), conspicuously clamped, not agglutinated or adherent, parallel and hardly branched inward, with cells cigar-to barrel-shaped, outward more interwoven, gnarled, freely branched; ampulliform clamps common, tibiiform, not unusually thick-walled, unornamented; gloeoplerous hyphae not observed. Subhymenium rudimentary. Hymenium thickening; basidia 68—75 × 8—9 μm, clavate, clamped; contents densely granular/guttulate, especially distally, weakly cyanophilous; sterigmata(2-)4, slender, long, straight.

Spores 8.6-11.2 × 4.3-5.4 μm ($E = 1.64-2.33$; $E^m = 2.5$; $L^m = 9.60\mu m$), ellipsoid, smooth to very obscurely undulate in profile; contents apparently uninucleate, homoeneous or 1—4-guttulate, the guttules dark yellow, subrefringent, well-to ill-defined; wall up to 0.2 μm thick; hilar appendix prominent, with pronounced throat; ornamentation of conspicuous to broken striae, abaxially longitudinal, adaxially obliquely abaxial-distal to adaxial-proximal.

Commentary: *Ramaria hemirubella* was described from one specimen from the market in Simao, in south-central Yunnan, The specimens below were purchased in the markets of San Ying village and Lijiang in north-central Yunnan. In all localities, the probable habitat was under pine, presumably *Pinus yunnanensis* in Er Yuan Prefecture. A more detailed commentary may be found with the original description.

Because of these additional collections, more accurate color notes can be furnished, as well as confirmation that apices are naturally deep red, not stained or secondarily suffused, Moreover, the pistillariform branches comprised only one portion of one fruitbody, the remainder exhibiting typical branches and apices.

We suspect that Wu (1986) treated this species under *R. botrytis* var. *holorubella* (Atk.) Corner. We have examined the type specimen of *Clavaria holorubella* and find its spores 12—15.6 × 3.5—5.0μm. Wu cited her measurements of Chinese material as 9.2—13 × 3—5 μm, closer to those of *R. hemirubella*.

One collection (no. 47285) produced spores substantially longer than those of others (10.8—13.7 × 3.6—4.7 μm; $E = 2.50-3.17$; $E^m = 2.82$; $L^m = 12.26$um). Basidia of these fruitbodies were predominantly 2-sterigmate, perhaps accounting for the spore size. Although longer than those of other collections of *R. hemirubella*, they were still considerably than those of *R. holorubella* and we find little reason to emphasize the collection further.

Specimens examined: Yunnan, Er Yuan Pref., San Ying village market, 27.

viii. 86, no. 56311 (TENN) HKAS: 20047; Lijiang Pref., Lijiang market, 30. viii. 86, no. 56348 (TENN); Lijiang market, 30. viii. 86, no. 56342 (TENN) HKAS: 20079; Lijiang market, 2. ix. 56390 (TENN); Simao market, 20. ix. 83, no. 45673(holotype, TENN; isotype, HKAS: 10420).

近似：斯氏丛枝瑚

Ramaria affin. **strasseri** (Bres.) Corner. Ann. Bot. Mem. 1950. 1:622.

Fruitbodies up to 14× 8 cm, obovate in outline. Stipe up to 8 × 6 cm, massive, with some abortive branchlets, rounded at base, somewhat laterally flattened, smooth, off-white at very base, otherwise pastel fleshy ochre ("light ochraceous buff"); flesh solid, off-white, moist but not slippery or gelatinous. Major branches few, stout. Branches in 3 — 5 ranks, hardly terete, concolorous with upper stipe; internodes all short; axils narrowly rounded below, lunate above. Apices curved, talon-like, awl-shaped, coarse, pallid avellaneous("vinaceous buff") to "avellaneous." Odor and taste negligible.

Macrochemical reactions: SYR = positive on rind only; IKI = weakly positive on outer stipe flesh; FCL = positive; ANO, ANW, GUA, PHN, PYR, NOH KOH = negative.

Tramal hyphae and basidia clamped. Basidial contents multiguttulate.

Spores 13.3—16.6×5.0—6.5μm (E = 2.35—2.86; E^m = 2.62; L^m = 15.06μm), boletoid to subboletoid, subtly undulate in profile; contents 1 — 4-guttulate, the guttules refringent, well-defined; wall up to 0.3 μm thick; hilar appendix prominent; ornamentation of coarse, diagonal striae.

Commentary: This abbreviated description represents only one fruitbody, but with avellaneous apices and large spores, the specimen is not contaxic with the in this subgenus described here.

Bresadola (1932) furnished a colored plate of *R. strasseri*(as *Clavaria*)showing no avellaneous shades, but his description read:"Truncus crassus…; rami…et avellaneo cinnamomeo-umbrini; ramuli…concolores; sporae…12—16× 4 — 6 μ…" No abortive branchlets were drawn nor described, and, of course, flesh amyloidity was not noted. In the absence of such details, the identity of *R. strasseri* remains in doubt for lack of fresh specimens, so the Chinese specimen cannot positively be declared synonymous. They are, nonetheless, too similar to be separated at this time.

Marr and Stuntz's (1973) concept of *R. strasseri* included "…apices occasio nally with a slight vinaceous cast, but more commonly turning 'grayish orange' (5B4 — 5) to 'dark brown' (6 — 7E, F8) with age or on drying…" while I conclude that their concept was incorrect for *R. strasseri*(see under *R. eryuanensis* for more discussion), the western North Americarn taxon seems quite similar to the Chinese specimen.

The specimen was collected at 3100 m under *Picea*, *Abies*, *Betula*, and *Rhododendron*.

Specimen examined: Yunnan, Lijianng Pref., Gan Erh Tse, (丽江，玉龙山，干海子)30 km NE Lijiang, 3.ix. 86, no. 47300 (TENN). Zang 56803 HKAS: 20041).

KEY TO DOCUMENED YUNNAN TAXA OF RAMARIA SUBG. LAETICOLORA

1. Basidia clamped 2
1. Basidia without clamp connections 11
2 (1). Branch color violet, purple, salmon, pink, but not yellow; apices of various colors 3
2. Branch color yellow or cream, but without red or purple component; apices of various colors 9
3 (2). Branches and apices purple to violet, fading to tan with spore production ..... **R. asiatica**
3. Branches and apices without violet or purple color 4
4 (3). Upper stipe, lower branches and apices yellow; middle and upper branches salmon colored 5
4. Upper stipe and lower branches concolorous with or paler than branches, but not golden yellow; apices cream colored or yellow 6
5 (4). Stipe slender, narrow, with abortive branchlets; stipe flesh amyloid; spores 8.3—11.2×4.3—5.0μm (L^m = 9.8μm) ..... **R. linearioides**
5. Stipe large, without abortive branchlets; stipe flesh inamgloid; spors 12.6—15.8× 5 —6.1μm (L^m = 14.2 um) ..... **R. distinctissima**
6 (4). Spores smooth, 8.3—10.8× 4 —4.7 μm (L^m = 9.3um); branches pallid fleshy cream; apices cream colored ..... **R. laeviformosoides**
6. Spores rough 7
7 (6). Spores 6.8—7.9×3.2—4.0μm (L^m = 9.3 um); branch flesh orange; branches salmon; apices cream colored ..... **R. nanispora**
7. Spore L^m = >9.5μm; branch flesh paler than hymenium 8
8 (7). Spores 10.8—14× 5 —6.1 μm(L^m = 11.7μm); stipe flesh inamyloid; branches pastel salmon; apices yellow ..... **R. formosa**
8. Spores 8.3—11.9× 4 --4.7 μm (L^m = 10.2μm); stipe flesh amyloid; branches salmon to salmon-orange; apices chrome yellow ..... **R. rubricarnata** var. **laeta**
9. Stipe base naturally stained dark red to red-brown; spores 9.4—11.5×4.3—5.0 μm (L^m = 10.5μm) ..... **R. sanguinipes**
9. Stipe base off-white, brunnescent but not rubescent 10
10 (9). Spores smooth, 11—14× 4 — 5 μm (L^m = 12.2μm) stipe large; branches yellow; apice bright greenish yellow; surfaces brunnescent ..... **R. brunneipes**
10. Spores rough, with striiform ornamentation, 8 —9.7× 4 — 5 μm (L^m = 8.8μm); stipe small; branches and apices cream-yellow ..... **R. zebrispora**
11 (1). Branches and apices bright rosy red to red, fading by maturity; spores 7.2—8.3×4.3—5.0 μm (L^m = 7.75μm ..... **R. indo-yunnaniana**
11. Branchs salmon, pink, yellow, but not bright rosy red 12

12 (11). Stipe base naturally stained ruby red, red-brown or orange-brown; branches pastel yellow; apices bright yellow……13

12. Stipe base off-white, sometimes brunnescent, but not rubescent ……14

13 (12). Spores 11.5-15.8×4.7-5.4 μm (L^m = 13.4 μm) …… **R. rubri-attenuipes**

13. Spores 7.6—10.1×3.6—5.0 μm (L^m = 8.87μm) …… **Ramaria taxon 1**

14 (13). Stipe and lower branch flesh gelatinous; tramal hyphae agglutinated……15

14. Stipe and lower branch flesh moist but not gelatinous or soapy; tramal hyphae free……17

15 (14). Branches cram colored; apices bright coral ered; branch flesh off-white; spores 6.5—9 × 4 — 5 μm (L^m = 7.5μm)……**R. botrytoides** var. **microspora**

15. Branches salmon-colored to fleshy golden yellow; apices yellow……16

16 (15). Branch flesh off-white, paler than hymenium; lower branches yellow; spores 7.9—10.8×4.3—5.0 μm (L^m = 9.7μm); upper branches fleshy golden yellow …… **R. hilaris**

16. Branch flesh carrot orange; branches salmon colored, quickly fading after picking; apices bright yellow; spores 9—12.2×4.7—6.5 μm (L^m = 10.3μm) …… **R. ephemeroderma**

17 (14). Stipes attenuate, fasciculate; spores 7.2—9.4×4.7—5.4 μm (L^m = 7.9μm); lower branches pallid salmon; upper branches and apices clear yellow; flesh hollow…… **R. sino-conjunctipes**

17. Stipe single, small and attenuate to large and rounded ……18

18 (17). Lower branches and apices yellow to golden yellow; branches salmon-orange; stipe small, rounded, appearing fasciculate; spores 10—13.7×4.3—5.8 μm (L^m = 11.6 μm), inconspicuously roughened……**R. linearis**

18. Lower branches and upper stipe paler than branches, but not yellow or golden yellow; stipe large, rounded; branches pallid salmon to salmon; apices light yellow; spores 10.4—12.6×5 — 6 μm (L^m = 11.5μm), conspicuously roughened……**R. neoformosa** var. **sinensis**

1. 亚洲枝瑚

Ramaria asiatica (Pet. et Zang) Petersen. 1988. Sydowia (in press)

= *Ramaria violaceibrunnea* var. *asiatica* Petersen and Zang. Acta Bot. Yunnan 1986. 8:291.

Fruitbodies up to 11×4.5cm, repeatedly branched, obovate in profile. Stipe up to 3 × 2 cm, single to falsely fasciculate, fleshy, solid, rounded to rooting at base, more or less equal, sometimes with very few abortive branchlets, white where protected, upward gradually pallid dull violaceous ("vinaceous drab"), with common areas of brown or tan ("cameo brown"), soft; flesh white, dry, drying punky. Major branches 3 — 4, thick, fleshy, ascending, violaceous brown ("Natal brown", "army brown"), bruising slowly to "red ocher;" branches in 3 — 5 ranks terete, often obscurely rugulose; flesh tan ("tawny olive," "sayal brown," "wood brown, "dark olive buff"); internodes diminishing gradually upward; axils rounded. Apices slender, double-dichotomous, somewhat prolonged, "dark olive buff" when young, finally concolorous with branches. Taste negligible to faintly astringent; odor weakly fragrant, aromatic.

Macrochemical reactions: SYR = positive in spots; KOH = dark orange to copper

red; NOH = copper red to maroon; FCL = deep green; ANW = positive; GUA = equivocal to weakly positive; CRE, ANW, ANO, PYR, PHN, IKI = negative. Branch sections naturally darkly colored, obscuring most reactions.

Tramal hyphae of upper branches 3.5—8 μm diam, hyaline, clamped, hardly inflated, thin-walled, parallel, tightly packed, not agglutinated or adherent; ampulliform clamps up to 12 μm broad, not abrupt, somewhat thick-walled (wall up to 1.5 μm thick), unornamented. Subhymenium extensive, hyphal. Hymenium thickening; basidia 50—58 × 7 — 8 μm, clavate, clamped, hyaline; contents scattered-multiguttulate; sterigmata 4, spindly, straight.

Spores (Fig. 9) 10.4—12.2 × 5 —5.8 μm (E = 2.00—2.42; E_m = 2.15; L_m = 11.34 μm), ellipsoid, often with suprahilar depression, roughened in profile, yellowish; contents uni-to biguttulate, the guttules dark and refringent; wall up to 0.5 μm thick; hilar appendix broad, with no throat; ornamentation of complex meandering and anastomosing ridges and warts up to 0.3 μm high.

Commentary: A thorough discussion of this species and its affinities can be found with its original description (Petersen and Zang, 1986) and in a compilation of the *Ramaria* species with purple fruitbodies (Petersen, 1988 b), where it was deemed necessary to propose the elevation of the taxon to species rank. It seems distributed over the southern Himalayas, into western and central China.

In northern Yunnan, *R. asiatica* was collected at 3200 m under a mature forest of *Picea*, *Abies*, broad-leaved trees and undergrowth of *Sinarundinaria*. This forest seems especially rich in *Ramaria* taxa, and should be investigated further. Conversely, unlike other taxa, this species was not for sale at the local markets, although the type specimen (from Simao 思茅) was purchased, attesting to the edibility of its fruitbodies.

Specimens examined: Yunnan, Lijiang Pref., White Water, (丽江, 玉龙山, 白水河) 32 km NE Lijiang, 7. ix. 86, no. 47265 (TENN, HKAS); Simao, 20. ix. 83, no. 45674 (Holotype, TENN); (Isotype, HKAS: 10424)

2. 红顶丛枝瑚微孢变种

Ramaria botrytoides var. **microspora** Petersen et Zang, var. nov. Fig. 3

Ut varietate typica, sed: 1) sporae 6.5—9.0 × 4 — 5 um; et 2) ornatione sporae crassae.

Fruitbodies up to 10 × 7 cm, often cespitose, obtriangular to commashaped in outline. Stipe up to 3 × 2 cm, single, tapering sharply downward to an acute or gnarled base, involving significant substrate when picked, here and there pruinose, with scattered abortive branchlets; flesh solid, white or off-white, appearing hygrophanous, rubbery or firm-gelatinous in consistency, drying hard, cartilaginous; abortive branchlets bright rose pink where protected ("rose doree"). Major

branches 2—4, curved-ascending, hardly terete. Branches in 3—6 ranks, ascending, occasionally slightly divergent, hardly terete, very pale ochre when young ("pale ochraceous buff"), mellowing to pallid ochraceous by maturity("light ochraceous buff"); flesh solid, semigelatinous, firm, viscid, brittle, off-white. Apices finely divided, delicate, double-dichotomous, acute, bright rose-pink where protected or young ("scarlet"), fading rapidly where exposed to pastel rosy orange ("carrot red"), finally concolorous with branches in age ("light ochraceous buff"). Odor faintly fabaceous; taste negligible.

Stipe tramal hyphae 4—12 μm diam, hyaline, thin-walled, unclamped, tightly interwoven, heavily agglutinated; ampulliform inflations and gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3—10 μm diam, hyaline, thin-walled, agglutinated (agglutinating substance easily liberated into 2% KOH mounts as amorphous debris), clampless, strictly parallel, tightly packed; ampulliform inflations associated with septa, up to 13 μm broad, thick-walled (wall up to 1 μm thick), aliiform, unornamented; gloeoplerous hyphae not observed. Subhymenium extensive, pseudoparenchymatous; hyphe clampless, adherent, 1.5—2.5μm diam. Hymenium thickening; basidia 57—65×8—9 μm, clavate, clampless; contents homogeneous when young, with a few scattered guttules in age, especially in lower third of basidium; sterigmata 4, long, slender, curved.

Spores (Fig. 3) 6.5—9.0×4.0—5.0 μm ($E=1.50—2.00$; $E^m=1.76$; $L^m=7.65$ μm), short-cylindrical to broadly ellipsoid, flattened adaxially, occasionally pip-shaped, conspicuously roughened in profile; contents 1-several guttulate, the guttules dark yellow, ill-defined; wall up to 0.2 μm thick; hilar appendix prominent, perpendicular to spore axis, truncate; ornamentation of plate-like warts and short ridges randomly placed.

Commentary: Described originally from eastern North America (New York), *R. botrytoides* has been reported from southeastern Canada through the southern Appalachian Mountains. Recently, it has been collected in Oregon and California, and it has been reported previously from China. Fruitbodies are quite distinct both in the field and microscopically. Diagnostic characters include: 1) cream-colored branches with bright rosy pink, clustered apices; 2) common abortive clusters with rosy pink apices; 3) clampless basidia; and 4) firmly gelatinous flesh, reflected by heavily agglutinated hyphae. With all these characters constant across the whole geographic range, only three character suites seem to separate the Chinese collections from North American material. First, spores of the Chinese collection are smaller than the smallest spores of North American specimens. Second, spore ornamentation in the Chinese collection is significantly more prominent than that found in North American specimens. Thrid, the Chinese fruitbodies react with several

macrochemical reagents, while North American specimens seem relatively inert. All told, We prefer to keep the Chinese collection separate at an infraspecific rank.

The Yunnan collection was purchased at the Lijiang market, attesting to its edibility. It reportedly came from between Yung Shung County and Lijiang (永胜、丽江) and was gathered under *Pinus armandi*, *P. yunnanensis*, and *Quercus rehderiana*.

Specimen examined; Yunnan, Lijiang Pref., Lijiang market, 30. viii. 86, no. 47297 (holotype, TENN; isotype, HKAS; 20072)

3. 棕顶丛枝瑚

Ramaria brunneipes Petersen et Zang, sp.nov. Figs. 4, 5

Basidiocarpi multiramosi, ad 20×13 cm, subglobosi ad sphaeropedunculati. Basi ad 4 × 4 cm, diminutivi ad crassi, singulati, cum saepe ramuli abortivi, deorsum subalbi, brunnescens; caro albo, nongelatinoso. Rami superne et ramuli flavi deorsum et superne. Apices tenui ad crassi, flavi. Hyphae contextualis fibulatae, crassitunicatae. Basidia 95—110 μm longa, clavata, fibulata. Sporae 11.2—14.0×4.0—5.0 μm, cylindricae, laevae ad subcorrugatae.

Fruitbodies (Fig. 4) up to 20×13 cm, massive, circular to broadly obovate in outline. Stipe up to 4 × 4 cm, small to large, rounded to tapering sharply to acute or rooting base, smooth, with a few abortive stumps high on stipe or low on lower branches, off-white, very easily brunnescent ("snuff brown"); flesh off-white ("pale ochraceous buff"), slowly brewn when cut, solid, mottled-hygrophanous but not gelatinous or slippery, often with a yellowish band suffused near base, dry flesh firm but easily penetrated. Major branches 2—4, massive, hardly terete, ascending, yellow to greenish yellow when young or fresh ("pinard yellow," "buff yellow"), easily mellowing to pastel yellow-ochre through development ("light ochraceous buff," dull "orange buff"); flesh white, solid, not hygrophanous. Branches in 3—6 ranks, stout, ascending, sometimes somewhat divergent, concolorous with upper major branches; internodes all short when young, giving a squat, stout appearance, elongating below through development, diminishing gradually at maturity; axils rounded throughout. Apices sometimes finely divided, acute, doubledichotomous, usually gross, molar-like, short-digitate at maturity, bright yellow to ochraceous yellow ("antimony yellow," "pinard yellow"), off-white where protected ("light buff"). Odor negligible or faintly fragrant; taste negligible or fabaceous.

Macrochemical reactions; SYR = slowly positive; GUA, FCL = positive; ANW, PHN, PYR = weakly positive to negative; KOH = browning; CRE, ANO = negative; IKI = dark brown.

Stipe tramal hyphae 5—16 μm diam, hyaline, clamped, thick-walled (wall up to 1.5 μm thick), interwoven, not agglutinated or adherent; ampulliform clamps up

to 18 μm broad, asymmetrical, not unusually thick-walled, with extensive, coarse, stalactitiform ornamentation; gloeoplerous hyphae rare, 3—5 μm diam, yellow-refringent. Tramal hyphae of upper branches 4—28 μm diam, inflated especially in medullary regions, hyaline, conspicuously clamped, thin-to thick-walled (wall up to 1 μm thick locally), with common false clamps, loosely parallel; ampulliform inflations not observed; gloeoplerous hyphae occasional, 2.5—5 μm diam, yellow, refringent, with abrupt swellings. Hymenium thickening; basidia 95—115 × 10—11 μm, elongate-clavate, clamped; conents densely granular or guttulate at all ages; sterigmata 4, long, slender, straight.

Spores (Fig. 5) 11.2—14.0 × 4.0—5.0 μm ($E = 2.14—3.45$; $E^m = 2.71$; $L_m = 12.16$ μm), boletoid to cylindrial, flattened adaxially or with a suprahilar swelling, smooth in profile; contents (1—) 2 (—4)-guttulate, the guttules dark yellow, subrefringent, well-defined; wall up to 0.2 μm thick; hilar appendix not prominent, gradual, truncate; ornamentation usually none, occasionally a suggestion of ill-defined, moderately cyanophilous markings of delicate ridges and small patches, in more or less longitudinal orientation.

Commentary: Spore dimensions appear unusually variable, with one specimen bearing spores with $L^m = 12.68$ μm, the other as 11.64 μm. Overall L^m, therefore, is unreliable as a taxonomic character, until more collections are examined.

A taxonomic complex of smooth-spored taxa of subg. *Laeticolora* can be readily identified (cf. Petersen, 1988c). Fruitbodies of all included taxa are yellow to pale yellow, with brighter yellow or greenish yellow apices, with abortive branchlets or stumps almost always present. Included at this time are two eastern North American taxa (*R. obtusissima* var. *obtusissima* and *R. highlandensis*, see below) which fruit in summer, one western North American taxon and its varieties (*R. magnipes* var. *magnipes* and var. *albidior*), both vernal fruiters, two European taxa (*R. obtusıssima* var. *scandinavica* and an undescribed taxon), and one taxon from North America and Europe (*R.* rasilispora var. *scatesiana*). All the western North American taxa show weakly amyloid stipe flesh but otherwise are macrochemically inert. *Ramaria obtusissima* reacts feebly in GUA, but produces larger spores than *R. brunneipes*. Only the hitherto undescribed *R. highlandensis* matches *R. brunneipes* in virtually all respects. It is being described elsewhere.

The IKI reaction of stipe flesh is brown, not blue, bray-blue or blue with yellowish tints as it is for *R. magnipes* and *R. rasilispora*. As explained elsewhere (Petersen and Scates, 1989), the brown, violet-brown or red-brown reaction is is usually cited as dextrinoid, not amyloid, and is typical of the *R. rubripermanens-R. rubrievanescens* complex of subg. *Ramaria*.

Diagnostic characters for *R. brunneipes* are as follows: 1) yellow fruitbodies

easily and extensively brunnescent; 2) clamped, long basidia; and 3) smooth, virtually unornamented spores.

In R H. Petersen's experience, coarsely dentate apices are often indicative of fruitbodies erumpent through considerable substrate. This is true of the western North American taxa listed above, as well as other vernal, partially hypogeous fruitbodies. In *R. brunneipes*, some fruitbodies, or even portions of fruitbodies, produce such apices, while other parts exhibit finely divided, more typical apices. he has no evidence of subterranean fruitbody ontogeny in *R. brunneipes*.

Both collections cited below were purchased in the Lijiang market, attesting to the edibility of fruitbodies of the species. Others of the complex (*R. magnipes*, *R. rasilispora*) are commonly eaten also, but Petersen has no reports on *R. obtusissima* or *R. highlandensis*.

Specimens examined: Yunnan, Lijiang Pref., Lijiang market, 6. ix. 86, no. 47304 (TENN); Lijiang market, 9. ix. 86, no. 47303 (holotype, TENN; isotype, HKAS: 20048).

4. 高生丛枝瑚

Ramaria distinctissima Petersen et Zang, sp. nov. Fig 6

Basidiocarpi multiramosi, ad 14×7 cm, obpyriforme. Basi ad 7×3.5 cm, crassi, singulati, sine ramuli abortivi, flavo-aurea superne; contusi brunnescenti; caro albo, non-gelatinoso. Rami flavo-aurei deorsum; ramuli pallide flavo-aurantii ad

Figs. 6—9. *Ramaria* fruitboby and spores. 6. *R. distinctissima* spores, TENN 47266. 7, 8. *R. ephemeroderma*. 7. Fruitbody. 8. Spores, TENN 47273. 9. *R. formosa* spores, TENN 47286, Standard bar = 5 μm for spores.

pallide aurantii. Apices tenui, aurea-aurantii. Hyphae contextualis afibulatae, tenui-ad crassitunicatae. Basidia 85—95 μm longa, clavata, fibulata. Sporae 12.6—15.8 × 5.0—6.1 μm, elongato-ellipsoidae, subcorrugatae.

Fruitbodies up to 14 × 7 cm, obpyriform in outline. Stipe up to 7 × 3.5 cm, single, tapering gradually to the acute, often rooting base, tomentose at base, smooth upward, without abortive branchlets, off-white where protected, upward bright yellow to golden yellow ("apricot yellow," "baryta yellow"), easily brunnescent ("hazel") around substrate bruises but not on handling; flesh white, solid, moist but not slippery, drying brittle, penetrated with difficulty but not impenetrable. Major branches 2—4, terete, ascending, concolorous to stipe below, concolorous to branches above. Branches in 3—6 ranks, terete, ascending, pastel yellow orange or yellow below ("orange buff," "light orange yellow," "light cadmium"), upward pastel orange ("capucine orange," "capucine yellow"); internodes diminishing gradually upward at maturity; axils narrowly rounded below, rounded above; flesh somewhat yellower than hymenium, white inward, drying brittle, friable. Apices stiff, double-dichotomous when youug, elongating to short-digitate. by maturity, rich golden orange to yellow-orange ("cadmium orange," "deep chrome," "Mikado orange"). Odor negligible or faintly fresh; taste negligible.

Macrochemical reactions: SYR = slowly but strongly positive; FC = positive; ANO, PHN, ANW, GUA = weakly positive to negative; KOH, NOH = leaching peach or yellow; CRE, IKI = negative.

Stipe tramal hyphae 4—15 μm diam, hyaline, thin-to thick-walled (wall up to 0.3 μm thick), interwoven, usually clampless, tightly packed; ampulliform swellings up to 15 μm broad, often not associated with septa, not unusually thick-walled, with extensive but delicate stalactitifom ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 4—18 μm diam, inflated especially inward, hyaline, thin-to thick-walled (wall up to 0.5 μm thick), almost always clampless, parallel, not agglutinated or adherent; cells cigar-shaped; ampulliform swellings and gloeoplerous hyphae not observed. Subhymenium rudimentary, pseudo-parenchymatous; hyphae 1.5—3 μm diam, conspicuously clamped. Hymenium thickening; basidia 85—95 × 10—12 μm, clavate, clamped, in tight cymes; contents homogeneous when young, with scattered refringent guttules by maturity, weakly cyanophilous; sterigmata 4, up to 6 μm long, spindly, straight; young basidia occasionally emergent as leptocystidia.

Spores (Fig. 6) 12.6—15.8 (-16.2) × 5.0—6.1 μm ($E = 2.25—3.07$; $E^m = 2.55$; $L^m = 14.16$ μm), long-ellipsoid to subboletoid, conspicuously roughened in outline; contents 1-several-guttulate, usually with a single refringent guttule; wall up to 0.3 μm thick; hilar appendix gradual, not prominent, with apparent struma;

ornamentation of prominent, discrete, low warts and short meandering ridges.

Commentary: The yellow to golden yellow coloration of the upper stipe and lower major branches is usually strikingly distinct from the salmon-orange of the branches (whence the species epithet), and the orange component grows more intense upward, so the apices are most intensely colored. This coloration serves as a good marker for field identification. With this, other diagnostic characters for *R. distinctissima* are: 1) prominent basidial clamp connections (especially when contrasted to the clampless tramal hyphae); 2) discrete, tapering, single stipe; and 3) large, coarsely ornamented spores with prominent guttules.

The virtually indistinguishable var. *americana* (Petersen, 1988 d) fruits in northwestern North America. From the typical variety, it differs only in the following characters: 1)the fruitbody stipe is more sharply tapered into an obconic base; 2) tramal hyphae of upper branches are strictly thin-walled; 3) basidia are somewhat wider than those of var. *distinctissima*; and 4) spore contents are often indistinctly guttulate, instead of including well-delimited guttulae.

Variety *distinctissima* was collectd in the field as well as in the markets. Its edibility is assured. Dominant vascular plants of the highaltitude (3000—3300 m) collecting areas were *Pinus densta*, *P. armandii*, *Picea*, *Abies*, *Betula*, *Rhododendron*, and *Sinoarundinaria*. Only *Picea* and *Abies* were present at all three sites.

Specimens examined: Yunnan, Lijiang Pref., Gan Erh Tse (Dry Sea Plain), (丽江，玉龙山，干海子), 30 km NE Lijiang, 3. ix. 86, coll. A. M. Evans, No. 47266(holotype, TENN; isotype HKAS: 17873); Black Water River Gorge, 玉龙山，黑白水 55 km NE Lijiang, 8. ix. 86, coll. Zang Mu, no. 47268 (TENN); White Water, 32 km NE Lijiang, 7. ir. 86, no. 47275 (TENN); Lijiang market, 6. ix. 86, no. 47290 (TENN).

5. 枯皮丛枝瑚

Ramaria ephemeroderma Petersen et Zang, sp. nov. Figs. 7, 8

Basidiocarpi multiramosi, ad 13× 6 cm, sphaeroideae ad ellipsoidae. Basi ad 3 × 2 cm, crassi, singulati, sine ramuli abortivi; contusi nonbrunnescenti; caro albo, gelatinoso. Rami et ramuli salmonicolor, in sicco pallide incarnati; caro gelatinoso, aurantio. Apices tenui, flavi. Hyphae contextualis afibulatae, crassitunicatae agglutinatae. Basidia 55—62 μm longa, clavata, afibulata.Sporae 9.0—12.2 × 4.7—6.5 μm, ellipsoidae, subcorrugatae.

Fruitbodies (Fig. 7) up to 13× 6 cm, circular to broadly fusiform in outline. Stipe up to 3 × 2 cm, single, falsely fasciculate, lobed or muscled, tapering to a blunt base, spongy when pressed, pruinose between major branches, otherwise smooth, with no abortive branchlets, off-white, not brunnescent; flesh firmly

gelatinous, slippery, off-white below, pastel orange ("cppucine orange") at junction with major branches. Major branches 3-several, curved-ascending, hardlyterete, pallid salmon-pink ("light ochraceous salmon") with some areas rich yellow ("light orange yellow"). Branches more or less terete, in 3—7 ranks, ascending, salmon color ("salmon pink," "flesh ocher," "ochraceous salmon"); branch surface (hymenium) quickly fading after picking to pale pink or pale salmon pink ("seashell pink to almost white"); branch flesh watery gelatinous, stuffed to hollow, brittle, bright orange ("apricot orange," "salmon ocher," "bittersweet orange") remaining so during drying, drying horny, cartilaginous; internodes diminishig gradually upward at maturity; axils lunate to narrowly rounded. Apices fine, delicate, doubledichotomous when young, delicately digitate by maturity, bright yellow ("antimony yellow," "apricot yellow," "mustard yellow," "maize yellow," "buff yellow"). Odr fainty fresh or penetrating; taste negligible.

Macrochemical reactions: SYR = stongly positive, often slowly; FCL = positive, sometimes weakly; GUA, ANW, PNH, ANO, GUA = sometimes positive, and then often tardy and/or weak; NOH, KOH, PYR, CRE, IKI = negative. Dry branch flesh in 2% KOH slowly yellow orange, then fading.

Stipe tramal hyphae 4—11 μm diam, hyaline, thick-walled (wall up to 1 μm thick), heavily agglutinated, clampless, more or less parallel; gelatin insoluble in KOH, ofter separating individual hyphae by 15 μm or more; ampulliform swellings up to 13 μm broad, not unusually thick-walled, with extensive, coarse stalactitiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3—11(-20) μm diam, hyaline, clampless, thin-walleed, agglutinated to adherent, strictly parallel, tightly packed, less agglutinated outward; ampulliform swellings not observed. Subhymenium abrupt, rudimentary; hyphae 2—5 μm diam hyaline, thin-walled, clampless, parallel inward, interwoven to perpendicular outward, not agglutinated or adherent. Hymenium thickening, loosely arranged; basidia 55—62 × 7—9 μm, clavate, clampless; contents homogeneous or with scattered fine granules or guttules, hardly cyanophilous; sterigmata 4, short, spindly, curved.

Spores (Fig. 8) 9.0—12.2 × 4.7—6.5 μm ($E = 1.59-2.14$; $E^m = 1.90$; $L^m = 10.26$ μm), ellipsoid, flattened adaxially, conspicuously roughened in profile; contents 1—4-guttulate, the guttules yellow, refringent; wall up to 0.2 μm thick; hilar appendix blunt, broad, hardly protuberant; ornamentation of large plate-like warts and/or complex, anastomosing ridges.

Commentary: Taxa of *Ramaria* subg. *Laeticolora* with gelatinous fruitbody flesh are numerous, and seem not to form a natural alliance. Of these, several exhibit salmon branches and yellow tips of varying color intensities. *Ramaria*

gelatiniaurantia var. *gelatiniaurantia* Marr and Stuntz from western North America, shows white flesh, fasciculate stipes and yellow lower branches. *Ramaria ochraceo-salmonicolor* (Clel.) Corner from Australia, and *R. gelatiniaurantia* var. *violaceitingens* Marr and Stuntz from western North America produce less intense coloration and narrower spores than *R. ephemeroderma*. *Ramaria subtilis* (Coker) Schild from eastern North America, shows white flesh with locally adherent hyphae (not gelatinous) and larger spores than *R. ephemeroderma*. Finally *R. flavigelatinosa* var. *megalospora* Marr and Stuntz, known from across northern North America, exhibits mottled white flesh and longer spores than *R. ephemeroderma*.

Diagnostic features of *R. ephemeroderma* are as follows: 1) salmon colored hymenium which quickly fades to almost white after the fruitbody is picked, revealing the carrot-orange, gelatinous flesh beneath; 2) lack of clamp connections; and 3) characteristic wide, conspicuously guttulate spores. Also unquie, although difficult to observe, is the abrupt transition from gelatinous flesh to free subhymenium and loosely arranged hymenium.

The authors can find nothing like this taxon in the Indian literature, and must assume that it has not been found in the eastern Himalayas.

Fruitbodies of *R. ephemeroderma* are sold in the markets of northern Yunnan, so are assumed edible. The species seems to favor habitats with *Pinus armandi*, *P. yunnanensis*, and *Quercus rehderiana*.

Specimens examined: Yunnan, Lijiang Pref., Gan Hai Tse (Dry Sea Plain), (玉龙山，干海子) 30 km NE Lijiang, 3. ix. 86, coll. A. M. Evans, no. 47270 (holotype-TENN; isotype-HKAS); between Yung Shung Co. and Lijiang, (永胜，丽江一带)2000—3000 m, 30. viii. 86, no. 47278(TENN, HKAS); Lijiang market, 6. ix. 86, no. 47273 (TENN).

6. 美丛枝瑚

Ramaria formosa (Pers.: Fr.) Ouelet. Flore Mycol., 1888. p. 466. Fig. 9

Fruitbodies up to 11 × 7 cm, subcircular to very broadly obpyriform in outline. Stipe up to 5 × 4 cm, single (rarely) to stoutly falsely fasciculate to fasciculate, occasionally rooting somewhat, tomentose at base, smooth above, off-white ("pale ochraceous salmon"), with no abortive branchlets, slowly brunnescent where handled or chaffed; flesh solid, moist but not slippery or gelatinous, off-white to pale pink ("seashell pink"), drying soft, easily penetrated, but not friable. Major branches 2—4, ascending, more or less terete. Branches in 3—6 ranks, terete, pallid salmon colored ("light ochraceous salmon"), often longitudinally rugulose; flesh pinkish beneath hymenium, off-white inward; internodes diminishing gradually upward; axils lunate. Apices cusped when young, digitate by maturity,

pastel cream to yellowish cream color ("cream color," "light ochraceous buff"). Odor and taste negligible.

Macrochemical reaction: SYR = slowly strongly positive; GUA, ANO, ANW, PHN, PYR, FCL = positive; KOH = copper colored; IKI, CRE = negative.

Stipe tramal hyphae 4—12 μm diam, hyaline, gnarled, freely branched, interwoven, thick-walled (wall up to 2 μm thick, rarely obscuring cell lumen), occasionally clamped, not agglutinated or adherent; ampulliform clamps asymmetrical, not unusually thick-walled, with extensive stalactitiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 2.5—20 μm diam, hyaline, thick-walled (wall up to 0.5 μm thick), occasionally clamped, secondarily septate, parallel, not agglutinated or adherent; contents often obscurely heterogeneous; ampulliform clamps up to 12 μm broad, thick-walled (wall up to 1 μm thick), unornamented; gloeoplerous hyphae rare, 3—5 μm diam, as short, undelimited lengths. Subhymenium rudimentary, pseudoparenchymatous. Hymenium thickening; basidia 70—80×10—11 μm, clavate, clamped; contents densely granular, apically refringent when mature, strongly cyanophilous distally; sterigmata 4, stout, curved.

Spores (Fig. 9) 10.8—12.2 (—14.0) ×5.0—5.8 (—6.1) μm (E = 2.00—2.43; E^m = 2.20; L^m = 11.67 μm), cylindrical to ellipsoid, flattened adaxially, subrefringent, conspicuously roughened in profile; contents unclear, obscured by refringence; wall up to 0.3 μm thick; hilar appendix prominent, often beaklike, papillate; ornamentation of flat, plate-like warts covering significant wall surface.

Commentary: Both collections cited below fruited under *Pinus densata* and *Quercus*, probably *Q. monimotricha*. Although reportedly mildly toxic in North America and Europe, fruitbodies were purchased in Lijiang market, indicating their edibility.

These collections show no discrepancies from correctly named European and North American specimens. Diagnostic characters include: 1) fruitbody color pattern of salmon branches and yellow apices; 2) stout, compound stipe easily brunnescent; 3) clamped, strongly cyanophilous basidia; 4) large, coarsely ornamented spores; and 5) macrochemical reactivity. Spores of the type specimen (Petersen, 1976) are 10.7—15.5×5.6—6.7 μm (E = 1.81—2.38; E^m = 2.06; L^m = 12.2 μm). While We have no reports on macrochemical reactions on European specimens, North American material reacts just as Chinese.

Fruitbodies of both specimens cited below were somewhat waterlogged, and stipe flesh, while easily penetrated when dry, was not friable as typical of the species. Flesh of properly dried fresh fruitbodies might be more friable.

Speecimens examined: Yunnan, Lijiang Pref. Lijiang market, 30.viii. 86, no,

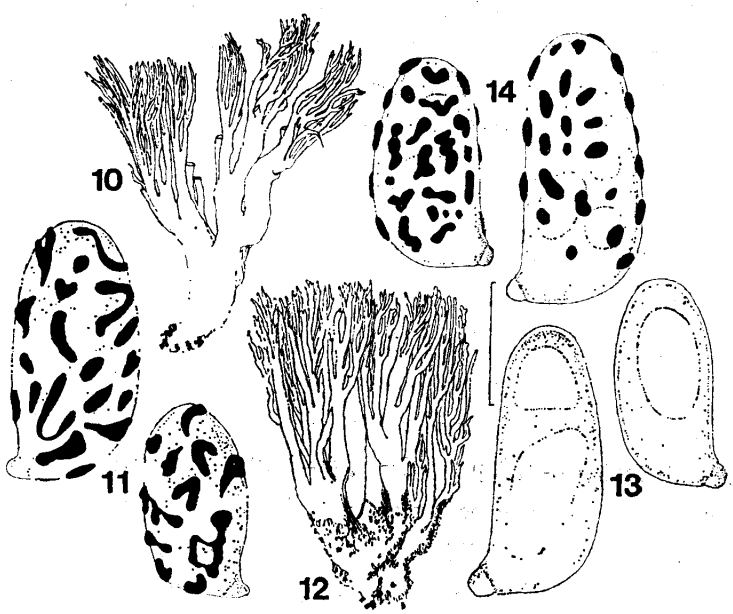
47286 (TENN); Yulong Shan, San Su He forest, 玉龙山，三疏河林带 1. ix. 86, coll. Zang Mu, no.47294 (TENN, HKAS: 20075).

7. 脐孢丛枝瑚

Ramaria hilaris Petersen et Zang, sp.nov. Figs. 10, 11

Basidiocarpi multiramosi, ad 12×4.5 cm, elongato-obpyriforme. Basi ad 5 × 2 cm, crassi, singulati, cum ramuli abortivi sparsi; contusi nonbrunnescenti; caro albo, lubrico. Rami falvi. Ramuli aureo-flavi. Apices tenui, aureo-flavi. Hyphae contextualis afibulatae, tenui-ad crassitenuitunicatae. Basidia 55—65 μm longa, clavata, afibulata. Sporae 7.9—10.8×4.3—5.0 μm, ellipsoidae, subcorrugatae.

Fruitbodies (Fig. 10) up to 12×4.5 cm, elongate-obpyriform in outline. Stipe up to 5 × 2 cm, tapering downward evenly to narrowly rounded base, rooting, with 1 — 2 abortive barnchlets high on stipe, smooth, very clean, off-white below, yellow above, not brunnescent; flesh white, mottled or marbled, slippery when cut. Major branches two, terete, ascending, bright yellow ("pinard yellow"). Branches in 3 — 5 ranks, terete, curved, ascending, somewhat secund, fleshy golden yellow ("light orange yellow"); flesh paler than hymenium, solid, slippery, brittle; internodes long, diminishing gradually upward; axils rounded throughot. Apices short-digitate, somewhat divergent, bright golden yellow ("apricot yellow"). Odor and taste negligible.



Figs. 10—14. *Ramaria* fruitbodies and spores. 10, 11. ***R. hilaris***. 10. Fruitbody. 11. Spores, TENN 47307. 12, 13. ***R. laeviformosoides***. 12. Fruitbody. 13. Spores, TENN 47295. 14. ***R. linearioides*** spores, TENN 47302. Standard bar = 5 μm for spores.

Macrochemical reactions: FCL, SYR = positive; ANO, ANW, GUA, PHN, PYR, IKI, KOH, NOH, CRE = negative.

Stipe tramal hyphae 3—10 μm diam, hyaline, clampless, thin-to thick-walled (wall up to 0.5 μm thick), tightly packed, more or less parallel, agglutinated, with occasional lacunae of agglutinating material; ampulliform inflations at septa, up to 15 μm broad, asymmetrical, not unusually thick-walled, extensively ornamented; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3—7 μm diam, hyaline, clampless, thin-walled, strictly parallel, tightly packed, adherent to semi-agglutinated, with frequent lacunae of agglutinating substance; ampulliform inflations at septa, up to 14 μm broad, thick-walled (wall up to 0.5 μm thick), delicately ornamented only at septum; gloeoplerous hyphae not observed. Subhymenium extensive, pseudoparenchymatous. Hymenium thickening; basidia 55—65 × 8—9 μm, clavate, clampless; contents with densely scattered refringent granules and/or guttules; sterigmata 4, slender, curved.

Spores (Fig. 11) 7.9—10.8 × 4.3—5.0 μm (E = 1.83—2.33; E^m = 2.04; L^m = 9.70 μm), ellipsoid, flattened adaxially, coarsely undulate in profile; contents with 1—3 dark yellow, subrefringent, ill-defined guttules; wall up to 0.2 μm thick; hilar appendix prominent, truncate; ornamentation of large, flat warts and anastomosing ridges.

Commentary: When collected, this specimen was thought to be *R. distinctissima*, but slippery flesh and lack of macrochemical reactivity differed from that species. Subsequently, *R. linearioides* was segregated, but both species produce clamped basidia. Fruibodies of *R. linaeris* are also similar in stature and coloration, but flesh is not gelatinous and spores are larger.

Diagnostic characters for *R. hilaris* are as follows: 1) yellow lower branches and apices, with fleshy golden yellow upper branches; 2) clampless basidia; 3) gelatinous stipe and branch flesh; and 4) neat, clean, slender, tapering stipe. The abortive branchlets are slender and graceful, rather than cauliflower-like as in most other taxa. The species epithet denotes the cheerful appearance of the fruitbodies.

The marbled, slippery flesh is reflected in microscopic agglutination. The agglutinating substance is so plentiful that gloeous lacunae are formed in flesh tissues. While softening in 2% KOH (in dried material), the substance remains rubbery and resists squashing in mounts.

The specimen was gathered at 3200 m, under *Abies*, *Picea*, *Quercus*, and *Sinarundinaria*. This forest type especially rich in *Ramaria* taxa. In different aspects of the hilly terrain, *Pinus densata* and *P. armandi* also abound.

Specimen examined: Yunnan, Lijiang Pref., White Water, (玉龙山，白水) 32

km NE Lijianng, 7. ix. 86, no. 47307 (holotype, TENN; HKAS: 20046).

8. 光孢丛枝瑚

Ramaria laeviformosoides Petersen et Zang, sp. nov. Figs. 12, 13

Basidiocarpi multiramosi, ad 11 × 7 cm, sphaeroideae ad crassi-obovati. Basi ad 6 × 5 cm, crassi, singulati, sine ramuli abortivi; contusi brunnescenti infirme; caro albo, non-gelatinoso. Rami et ramuli pallide cremeo-incarnati. Apices crassi, pallide cremei. Hyphae contextualis fibulatae, tenui-ad crassitenuitunicatae. Basidia 60—70 μm longa, clavata, fibulata. Sporae 8.3—10.8 × 4.0—4.7 μm, cylindricae, laevae.

Fruitbodies up to 11 × 7 cm, circular to broadly obovate in outline. Stipe up to 6 × 5 cm, single, ridged so as to appear fasciculate, pruinose at base, smooth upward, with no abortive branchlets; white downward, weakly brunnescent; flesh solid, white, moist but not slippery or gelatinous, soft, drying firm but easily penetrated, not friable, yellow downward. Major branches several, ascending, terete, concolorous with stipe downward, concolorous with branches upward, weakly brunnescent. Branches in 3 — 6 ranks, terete, strict, pallid fleshy cream colored ("pinkish buff"), fading by maturity to "cream buff;" flesh paler than hymenium, soft; internodes all short when young, elongating from below, diminishing gradually upward at maturity; axils rounded throughout. Apices coarse, acute, divaricate when young, stiffly digitate at maturity, pastel cream color ("light achraceous buff") when young, concolorous with branches in age. Odor faintly penetrating; taste negligible.

Macrochemical reactions: SYR = positive on rind only; GUA, ANO, ANW, PHN, PYR, FCL = positive to weakly positive; KOH = copper colored; IKI = greenish on stipe flesh.

Stipe tramal hyphae 3 —23 μm diam, usually inflated, hyaline, thin-to occasionally thick-walled (wall up to 1 μm thick locally), interwoven, tightly packed, not agglutinated or adherent; ampulliform clamps up to 16 μm broad, asymmetrical, thick-walled (wall up to 1.5 μm thick), with coarse stalactitiform ornamentation; glocoplerous hyphae rare, as clavate cell tips, undelimited at narrow end, yellow-refringent. Tramal hyphae of upper branches 3 — 12 μm diam, hyaline, thin-to thick-walled (wall up to 0.5 μm thick locally), clamped, secondarily septate, strictly parallel, not agglutinated or adherent; ampulliform clamps up to 14 μm broad, asymmetrical, thick-walled (wall up to 1 μm thick), unornamented; glocoplerous hyphae occasional, 2 —3.5 μm diam, refringent. Subhymenium rudimentary, pseudoparenchymatous. Hymenium thickening; basidia 60—70 × 9 —10 μm, clavate, clamped; contents densely granular and/or with a few small refringent guttules; sterigmata (2 —) 4, short, spindly, straight.

Spores (Fig. 13) 8.3—10.8 × 4.0—4.7 μm (E = 1.93—2.54; E^m = 2.25; L^m =

9.32 μm), cylindrical, smooth or extremely obscurely undulate in profile; contents homogeneous, or with 1—2 obscure, ill-defined, dark inclusions; wall up to 0.2 μm thick; hilar appendix small, not prominent, truncate; ornamentation none.

Commentary: When collected, the specimen was thought to be *R. formosa*, which it resembles in stature, brunnescence, and general coloration. Indeed, the similarity continues into macrochemical reactivity, soft stipe flesh when fresh and dry, and clamped basidia. Spore morphology is quite different, however: those of *R. laeviformosoides* are smooth, with no ornamentation, while those of *R. formosa* are conspicuously roughened and coarsely ornamented. Spore dimensions also differ [*R. formosa*: 10.8—12.2 (-14) × 5.0—5.8 (-6.1) μm; $E^m = 2.20$; $L^m = 11.67$ μm], and basidia are smaller and acyanophilous. More subtly, fruitbody colors are more muted than in *R. formosa*. The salmon shade is an opaque fleshy cream, while the apices show a very weak fleshy component to the cream color. Finally, the brunnescence of *R. laeviformosoides* in weaker than that of R. formosa, but just as extensive.

Ramaria laeviformosoides (etym.: *laevi*, indicating smooth spores; *formosoides*, similar to that species) is the first smooth-spored *Ramaria* without predominent yellow coloration. Diagnostic characters for the species include the following: 1) weak salmon and yellow coloration; 2) clamped but acyanophilous basidia; 3) smooth spores; and 4) macrochemical reactivity, including weakly amyloid stipe flesh. See also *R. brunneipes*, which produces yellow, brunnescent fruitbodies and longer spores.

Specimen examined: Yunnan, Lijiang Pref., Lijiang market, 1. ix. 86, no. 47295 (holotype, TENN; isotype, HKAS: 17744).

9. 拟细丛枝瑚

Ramaria linearioides Petersen et Zang, sp. nov. Fig. 14

Basidiocarpi multiramosi, ad 12× 5 cm, elongato-pyriforme. Basi ad 3 × 1 cm, tenui, singulati, cum ramuli abortivi subinde; contusi non-brunnescenti; caro flavulo ad albo, non-gelatinoso. Rami et ramuli pallid salmonicolor. Apices tenui, cremei. Hyphae contextualis fibulatae, crassitunicatae. Basidia 50—60 μm longa, clavata, fibulata. Sporae 8.3—11.2×4.3—5.0 μm ellipsoidae subcorrugatae.

Fruitbodies up to 12× 5 cm, elongate-pyriform in outline. Stipe up to 3 × 1 cm, single, slender, lobed to channelled, appearing fasciculate, smooth, with occasional abortive branchlets, off-white below, yellow ("antimony yellow") above, including abortive branchlets; flesh yellowish at base, off-white upward, fibrous, not gelatinous or slippery. Major branches several, ascending, more or less terete, yellow below, concolorous with branches above. Branches in 3—6 ranks, linear, more or less strict, terete, pastel salmon colored ("light ochraceous salmon"); flesh

paler; internodes long, diminishing gradually at maturity; axils narrowly rounded throughout. Apices long, awlshaped, dichotomous, "cream color." Odor and taste slightly fabaceous.

Macrochemical reactions: IKI = positive on stipe flesh; SYR, FCL, ANO = positive; CRE, GUA, PHN, PYR, ANW = negative.

Stipe tramal hyphae 3—12 μm diam, hyaline, gnarled, stiff, freely branched, thick-walled (wall up to 1.5 μm thick), conspicuously clamped, not agglutinated or adherent; ampulliform clamps up to 22 μm broad, more or less symmetrical, thick-walled (wall up to 2 μm thick, especially et septum), with extensive, coarse stalactitiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3—22 μm diam, hyaline, inflated, thin-to thick-walled (wall up to 0.5 μm thick), clamped, strictly parallel, not agglutinated or adherent ampulliform clamps up to 13 μm broad, aliiform, thick-walled only at septum, smooth or with very limited ornamentation, often including some refringent guttular material; gloeoplerous hyphae 1.5—2 μm diam, dark to refringent, occasionlly branched, strongly cyanophilous. Subhymenium extensive, pseudoparenchymatous. Hymenium thickening; basidia 50—60 × 8—9 μm, clavate, clamped, congested; contents heterogenous, usually with scattered amorphous granules throughout, moderately cyanophilous; sterigmata (1—2—3—) 4 slender, straight, in this specimen often distorted in size and placement.

Spores (Fig. 14) 8.3—11.2 × 4.3—5.0 μm (E = 1.71—2.33; E^m = 2.09; L^m = 9.77 μm), ellipsoid, smooth or obscurely undulate in profile; contents homogeneous or with 1—4 refringent, yellow inclusions; wall up to 0.2 μm thick; hilar appendix not prominent, appearing as an angular corner of the ellipsoid spore outline; ornamentation from very minute and gritty, to small, scattered plates and short meandering ridges.

Commentary: Macroscopically, this species is almost indistinguishable from *R. linearis*. Both share linear stature, salmon/yellow color pattern, yellow lower branches, and amyloid stipe flesh. A probable distinction, however, is the presence of abortive branchlets on the stipe in *R. linearioides*. Microscopically, the two are easily separated, for *R. linearioides* forms clamps on hyphae of all tissues, while *R. linearis* is clampless. Finally, spores of *R. linearis* are larger (10.1—13.3 × 4.3—5.8 μm; L^m = 11.6 μm) than those of *R. linearioides*.

No observations were recorded on brunnescence of stipe surfaces, but the possibility cannot be dismissed.

The specimen was purchased in a market, so can be presumed edible. Fruiting was reportedly under *Pinus yunnanensis*. The specimen was confined overnight in waxed paper, probably accounting for the distortion and misplacement of sterigmata. The

two spores depicted bore more ornamentation than most others. Sculpturing varied from virtually none through obscurely gritty to that illustrated here.

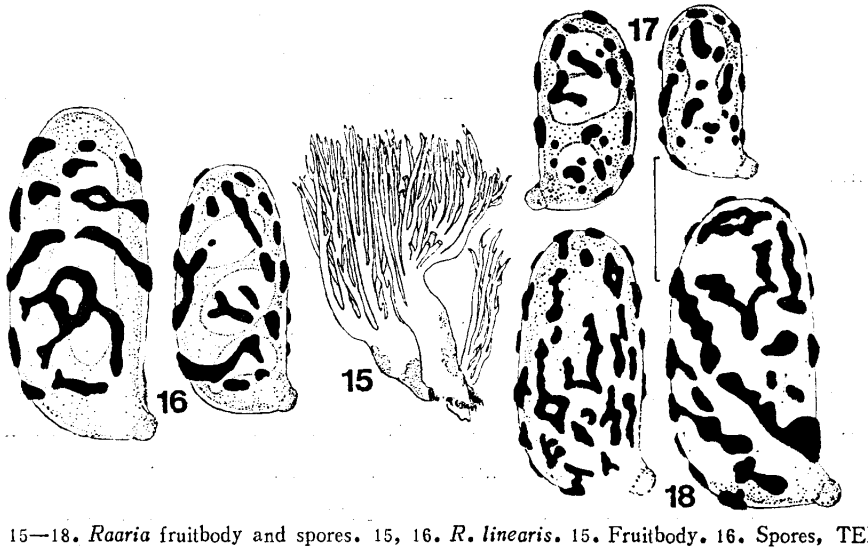
Specimen examined: Yunnan, Er Yuan Pref., San Ying village market, (洱源，三阳村) 27. viii. 86, no. 47302 (holotype, TENN; isotype, HKAS: 20044).

10. 细丛枝瑚

Ramaria linearis Petersen et Zang, sp. nov.

Basidiocarpi multiramosi, ad 14× 6 cm, elongato-obpyriforme. Basi ad 1 × 1.5 cm, parvi, singulati, cum ramuli abortivi; contusi brunnescenti debili; caro albo, non-gelatinoso, hygrophano; ramuli abortivi flavi. Rami deorsum flavi, ramuli pallide solmonicolor as pallide aurantii; caro aurantio. Apices tenui, aureo-aurantii ad pallide aurantii. Hyphae contextualis afibulatae, crassitunicatae. Basidia 57—65 μm longa, clavata, afibulata. Sporae 10.1—13.7×4.3—5.8 μm, tenui-ellipsoidae ad ellipsoidae, subcorrugatae.

Fruitbodies (Fig. 15) up to 14× 6 cm, linear, elongate obpyriform in outline. Stipe up to 1×1.5 cm, small, tapered to an acute base, white, smooth, often with abortive branchlets, reluctantly brunnescent on handling; flesh white, solid, moist but not slippery, often mottled-hygrophanous; abortive branchlets yellow to pastel orange ("antimony yellow", "light orange yellow, " "capucine orange"); surface of stipe and lower branches becoming grey upon drying. Major branches several, strictly ascending, more or less terete, clear yellow("light orange yellow," "buff yellow, " "apricot yellow"). Branches in 4 — 7 ranks, terete, more or less strict, orange, pastel orange to pastel salmon ("light ochraceous salmon," "capucine



Figs. 15—18. *Raaria* fruitbody and spores. 15, 16. *R. linearis*. 15. Fruitbody. 16. Spores, TENN 47301. 17. *R. nanispora* spores, TENN 47293. 18. *R. neoformosa* var. *sinensis* spores, TENN 47305. Standard bar = 5 μm for spores.

orange, ""ochraceous orange"), fading in age to "ochraceous buff;" internodes somewhat long throughout, diminishing gradually upward at maturity; axils narrowly rounded below, rounded above; flesh solid, sometimes slippery when cut, orange ("deep chrome"). Apices fine, delicate, knobby-digitate by maturity, somewhat divaricate, golden yellow to pastel orange ("light orange yellow, ""orange buff"). Odor negligible; taste negligible or faintly fungoid.

Macrochemical reactions: SYR = slowly strongly positive; IKI = slowly greenish to stongly positive; GUA, ANO, PYR, FCL = positive; ANW, PHN, CRE = negative.

Stipe tramal hyphae 4—12 μm diam, hyaline, thick-walled (wall up to 0.5 μm thick), clampless, tightly interwoven, not agglutinated or adherent; ampulliform swellings rare, not associated with septa, not unusually thick-walled, with coarse, extensive stalactitiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 4—11 μm diam, hyaline, clampless, thin-walled, parallel, tightly packed, free to locally adherent; ampulliform swellings not observed; gloeoplerous hyphae sometimes common, 2—3.5 μm diam, subrefringent to refringent, strongly cyanophilous. Subhymenium rudimentary; hyphae 1.5—2.5 μm diam, tightly packed, interwoven, clampless. Hymenium thickening; basidia 57—65 × 9—11 μm, clavate, clampless; contents homogeneous when young, usually with a few scattered refringent granules and/or guttules at maturity, moderately cyanophilous; sterigmata 4, short, spindly, straight to curved.

Spores (Fig. 16) 10.1—13.7 × 4.3—5.8 μm (E = 2.14—2.62; E^m = 2.36; L^m = 11.60 μm), narrowly ellipsoid to subboletoid, conspicuously roughened in profile; contents sludgy to guttulate, the guttules deep yellow, subrefringent, ill-defined; wall up to 0.2 μm thick; hilar appendix gradual, prominent, almost perpendicular to spore axis; ornamentation of prominent elongate warts and anastomosing, meandering ridges.

Commentary: Several combined characters are diagnostic for this species: 1) linear stature of fruitbodies, with small but single stipes superficially appearing fasciculate; 2) golden yellow lower branches combined with salmon or orange branches and golden yellow apices; 3) clampless basidia; 4) prominently roughened spores; and 5) strong macrochemical reactivity. When collected, the species was thought similar to *R. leptoformosa* Marr and Stuntz, which shares linear stature, salmon branches and yellow apices, and strong reactivity with macrochemicals. That species, however, produces clamped basidia, and lacks the color distinction between lower major branches and branches. Another taxon which could be confused with *R. linearis* is *R. distinctissima* var. *distinctissima*, which exhibits a large, single stipe, larger spores (L^m = 13.7 μm), and poor reactivity with macrochemicals.

Ramaria linearioides (*q. v.*) exhibits clamp connections and smaller spores, but is macroscopically quite similar to *R. linearis*.

Neither specimen cited below was collected from nature, but purchased in the Lijiang market. Number 47301 was reportedly found beneath *Pinus armandi*, *P. yunnensis*, and *Quercus rehderiana* between Yung Shung County and Lijiang. Fruitbodies are assumed to be edible.

Specimens examined: Yunnan, Lijiang Pref., Lijiang market, 30. viii. 86, no. 47301 (holotype, TENN; isotype, HKAS: 17729); Lijiang market, 6. ix. 86, no. 47291 (TENN).

11. 短孢丛枝瑚

Ramaria nanispora Petersen et Zang, sp. nov. Fig. 17

Basidiocarpi multiramosi, ad 10×7 cm, obpyriforme, geniculati. Basi ad 3×1.5 cm, tenui, singulati, sine ramuli abortivi; contusi brunnescenti debili; caro albo, non-gelatinoso. Rami et ramuli salmonicolor; caro aurantio-salmonicolor. Apices tenui, pallide cremei. Hyphae contextualis fibulatae, crassitunicatae. Basidia 48—55 μm longa, clavata, fibulata. Sporae 6.8—7.9×3.2—4.0 μm, cylindricae, subcorrugatae.

Fruitbodies up to 10×7 cm, obpyriform, geniculate. Stipe up to 3×1.5 cm, modest, tapering to narrowly rounded base, smooth, without abortive branchlets, off-white, weakly watery brunnescent where handled; flesh white, solid, fibrous, not gelatinous or slippery. Major branches several, ascending, flattened, congested upward, concolorous to branches. Branches in 3—7 ranks, more or less terete, salmon colored ("flesh ocher, ""ochraceous salmon"), retaining mauve coloration when dried; flesh brittle, snappy, bright salmonorange ("bittersweet orange"); internodes diminishing gradually at maturity; axils rounded throughout. Apices minutely double-dichotomous, elongating to curved-digitate, pale cream colored to fleshy cream colored ("pale ochraceous salmon," "light ochraceous buff"). Odor and taste weakly fabaceous.

Macrochemical reactions: SYR = quickly positive, quickly fading; IKI = weakly positive; FCL, ANO = positive; GUA = slowly positive; CRE, PHN, PYR, KOH, ANW = negative.

Stipe tramal hyphae 3—10 μm diam, hyaline, thick-walled (wall up to 1 μm thick), very tightly interwoven, clamped, not agglutinated or adherent; ampullifom clamps common, up to 14 μm broad, symmetrical, blunt, thick-walled (wall up to 1.5 μm thick), with coarse stalactitiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3—11 μm diam, hyaline, thin-walled, inconspicuously clamped or often unclamped, secondarily septate, short-celled, strictly parallel, adherent to free; ampulliform clamps and gloeoplerous

hyphae not observed. Subhymenium rudimentary. Hymenium thickening; basidia 48—55× 8—9 μm, clavate, clamped, congested; contents usually homogeneous distally, granular proximally, the granules refringent; sterigmata (1—2—3—) 4, straight slender.

Spores (Fig. 17) 6.8—7.9×3.2—4.0μm, (E = 1.90—2.33; E^m = 2.04; L^m = 7.24 μm), cylindrical, minutely rough in profile; wall up to 0.2 μm thick; hilar appendix grdual, not prominent; ornamentation of small, irregularly shaped plates randomly oriented.

Commentary: The bright salmon-orange branch flesh is reminiscent of *R. ephemeroderma*, but that species produces clampless septa and gelatinous flesh. Likewise, the salmon branches and cream colored apices are like those in *R. leptoformosa* Marr and Stuntz (1973), but fruitbodies of that species are quite linear, with fasciculate to (rarely) very small single stipes, spores are 8—13× 3—5 μm (L^m = 10.6, *teste* Marr and Stuntz; 9—10.4×4.3×4.7 μm; L^m = 9.66 μm, my measurements of non-type specimen), and stipe flesh is not amyloid. *Ramaria flava* var. *aurea* shows similar stature and colors, but its spores are larger [8.3—11.5(—12.6)×3.3—4.1 μm; L^m = 9.95 μm for the type; Petersen, 1982]. Finally, *R. rubricarnata* produces similar colors and amyloid stipe flesh, but fruitbodies are of different stature, and spores are larger (L^m = 9.8 μm in all varieties).

Sharda (1983) may have treated this taxon under *R. sandaracina* Marr and Stuntz or as a new variety of that species. Sharda's concept of *R. sandaracina* included orange branches *and* apices, and spores with L^m = 8.5 μm. Under "*R. sandaracina* var. nov., "apices were described as "deep yellow," flesh as white (but this could have meant only stipe flesh), and spores as 5.6—7 (—7.5)× 3—3.5 μm.

All in all, we cannot find an already described species concept for this specimen. It can be diagnosed as follows: 1) salmon/yellow color pattern; 2) bright orange branch flesh; 3) clamped, short basidia; 4) weakly amyloid stipe flesh; and 5) small, cylindrical spores. These spores are among the smallest we have seen in subgenus *Laeticolora*, and the species is derived from their small size.

In the only known collection, sterigmata are variable in number and often distorted in shape or placement. Specimens gathered that day (27. viii. 89) were confined in waxed paper overnight until dried the following day. Such confinement often results in such aberrations, reflected also in spore size (cf. *R. neoformosa* var. *sinensis*). In *R. nanispora*, spore size seemingly was not disturbed.

The specimen reportedly fruited under *Pinus yunnanensis*, and must be presumed edible.

Specimen examined: Yunnan, Er Yuan Pref., San Ying village market, (洱源, 三阳村) 27. viii. 86, no. 47293 (holotype, TENN; isotype, HKAS).

12. 新美丛枝瑚中华变种

Ramaria neoformosa var. **sinensis** Petersen et Zang, var.nov. Fig.18

Ut variete typica, sed: 1) sporae 10.4—12.6×5.0—6.1 μm (L^m = 11.52 μm); et 2) caro ramuli incarnato.

Fruitbodies up to 12×7 cm, obovate in outline. Stipe up to 5×4 cm, single, substantial, rounded at base, pruinose between substrate particles, smooth above, somewhat rugulose, off-white, brunnescent where handled; flesh off-white, soft, punky, not gelatinous or slippery, drying firm, easily penetrated, but not friable. Major branches 2—3, stout, short, terete. Branches in 3—6 ranks, terete, ascending, pallid salmon to salmon ("light ochraceous salmon," "ochraceous salmon"); flesh soft, beautiful bright pink; internodes diminishing gradually upward at maturity; axils narrowly rounded below, rounded above. Apices finely divided, crowded, cristate, pale cream colored ("pale ochraceous salmon") when young, short-digitate by maturity, retaining cream color. Odor negligible; taste negligible when fresh, bitter when dry.

Macrochemical reactions: SYR = slowly positive; ANO, ANW, FCL, GUA, PHN, PYR = positive; CRE, IKI = negative.

Stipe tramal hyphae 3—13 μm diam, hyaline, gnarled, stiff, freely branched, easily shattered in mounts, thick-walled (wall up to 2 μm thick), interwoven, not agglutinated or adherent; ampulliform septa up to 14 μm broad, gnarled-alii form, thick-walled (wall up to 3 μm thick), with delicate but extensive stalactitiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 4—12 μm diam, hyaline, thin-to thick-walled (wall up to 0.5 μm thick), parallel, clampless, tightly packed, not agglutinated or adherent; ampulliform inflations not always associated with septa, thick-walled (wall up to 1 μm thick), with delicate, extensive stalactitiform ornamentation; gloeoplerous hyphae not observed. Subhymenium rudimentary; hyphae 1.5—2 μm diam, clampless, tightly interwoven. Hymenium thickening; basidia 55—70×9—10 μm, clavate, clampless; Contents densely granular, especially distally, and often with numerous small guttules, strongly cyanophilous; sterigmata (1—2—3—)4, very variable in size, shape and location.

Spores (Fig. 18) 10.4—12.6×5.0—6.1 μm (E = 1.88—2.19; E^m = 2.04; L^m = 11.52 μm), ellipsoid, flattened adaxilly, conspicuously roughened in profile; contents homogeneous or with 1—2 dark, ill-defined inclusions; wall up to 0.3 μm thick; hilar appendix not prominent, subpapillate; ornamentation of very complex, narrow, meandering and anastomosing ridges.

Commentary: As explained previously (Petersen, 1976, 1986), *R. neoformosa* Pet. shares several superficial characters with *R. formosa*, including general color

pattern and fruitbody stature. The two are easily separated, however, for *R. formosa* produces clamped basidia.

Diagnostic characters for *R. neoformosa* include: 1) salmon/yellow color pattern; 2) clampless basidia; 3) substantial, single stipe; and 4) brunnescent surfaces where handled. Within the species, two varieties have been described. Variety *neoformosa* fruitbodies are macrochemically reactive (FCL, GUA, ANO = positive; KOH, NOH, PYR = negative; others not recorded), and spores are 10.7—11.8×4.8—5.6 μm (E^m = 2.09; L^m = 10.9μm). Variety *macrospora* Pet., known only from eastern Canada, is macrochemically inert (FCL = moderately positive; GUA, PYR, KOH, NOH, IKI = negative; others not recorded), with larger spores (11.2—14.8×3.6—4.3 μm; E^m = 3.01; L^m = 12.57 μm).

The sole Chinese collection exhibits aberrent sterigmata. Basidia are seen as 1—2—3—4—sterigmate, but sterigmata vary in disposition and size; often distorted, compound or irregularly placed, perhaps caused by storage of the specimen before drying. Spores, as might be expected, also vary considerably, especially in length. For this reason, spores were measured non—randomly, and maximum length (and therefore E, E^m, and L^m) may well be lower than a randon sample would produce. This would only make the specimen more difficult to place within the extant varieties. All told, We prefer to keep the Chinese collection separate on the following bases: 1) spore dimensions and statistics are different than either present variety, with the L^m of var. *macrospora* but the E^m (that is, wider spores) of var. *neoformosa*; and 2) bright pink branch flesh, in contrast to off-white branch flesh of the present varieties. When more material becomes available, this disposition may be altered.

The collection cited below was purchased in the market, attesting to its edibility. It reportedly fruited under *Pinus yunnanensis*.

Specimen examined: Yunnan, Er Yuan Pref., San Ying village market, (洱源三阳村) 27. viii. 86, no. 47305 (holotype, TENN; isotype, HKAS: 20043).

13. 朱细丛枝瑚

Ramaria rubri-attenuipes Petersen et Zang, sp. nov. Figs. 19, 20

Basidiocarpi multiramosi, ad 16×6 cm, crassi-fusiforme. Basi ad 5×2.4 cm, attentuati, singulati, rubescenti, cum ramuli abortivi; caro albo, non-gelatinoso. Rami et ramuli flavi ad flavo-ochracei. Apices tenui, flavi. Hyphae contextualis afibulatae, tenui-ad crassitunicatae. Basidia 75—92 μm longa, clavata, afibulata. Sporae 11.5—15.8×4.7—5.4 μm, ellipsoidae ad sudcylindricae, subcorrugatae.

Fruitbodies (Fig. 19) up to 16×6 cm, fusiform to broadly fusiform in outline. Stipe up to 5×2.4 cm, tapering gradually downward, usually attenuate, rooting,

often with some abortive branchlets, single, off-white, significantly rubescent over large areas to deep maroon ("Pompeian red," "madder brown"); flesh off-white, solid, not slippery, drying light in weight and easily penetrated. Major branches 3 — 5, curved-ascending, more or less terete, cream colored to off-white. Branches in 4 — 6 ranks, cream colored to ochraceous yellow when fresh("mustard yellow," "Naples yellow," "cream color"), often stained red in blotches, in age ochraceous buff ("light ochraceous buff," "cream buff"); internodes diminishing gradually at maturity; axils narrowly rounded. Apices fine, delicate, slightly divergent when young, blunt, digitate to mitten-shaped in age, pallid bright yellow ("mustard yellow," "pinardyellow") when young or fresh, in age sometimes suffused with pink ("onion skin pink"). Odor faintly fragrant to mildly fresh; taste negligible.

Figs. 19—21. *Ramaria* fruitbody and spores. 19, 20. *R. rubri-attenuipes*. 19. Fruitbody. 20. Spores, TENN 47268. 21. *R. rubricarnata* var. *laeta* spores, TENN 47292. Standard bar = 5 μm for spores.

Macrochemical reactions: SYR = positive, fading to pallid bright yellow ("pinard yellow"); ANW, PHN = occasionally weakly positive; FCL = positive; CRE, IKI, KOH, NOH, PYR, ANO, GUA = negative.

Tramal hyphae of stipe 4 —13 μm diam, hyaline, clampless, thin-to thick-walled (wall up to 1 μm thick), interwoven, tightly packed, not agglutinated or adherent; ampulliform septa up to 14 μm broad, blunt, not unusually thick-walled, with extensive, coarse, stalactitiform ornamentation, often not inflated or slightly so; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 5 —14 μm diam, hyaline, clampless, thick-walled (wall up to 1 μm thick), usually inflated, parallel, not agglutinated or adherent, tightly packed; ampulliform swellings not observed; gloeoplerous hyphae hardly discernable, moderately cyanophilous. Hymenium thickening; basidia 75—92×11—13 μm, clavate, clampless; contents finely to coarsely multiguttulate; sterigmata 4, stout, straight,

Spores (Fig. 20) 11.5—15.8×4.7—5.4 μm (**E** = 2.27—3.00; $\mathbf{E}^m$ = 2.69; $\mathbf{L}^m$ = 13.43 μm), ellipsoid to subcylindrical, "ochraceous buff" in prints, conspicuously roughened in profile; contents 1-several-guttulate, the guttules deep yellow, refringent; wall up to 0.2 μm thick; hilar appendix broad, truncate; ornamentation of anastomosing ridges and discrete, plate-like warts; struma not observed.

Commentary: This species was collected only above 2800 m, and seems to fruit only in habitats with *Abies* and *Picea*. Other nearby trees were *Pinus*, and *Betula*, with *Sinarundinaria* the understory in one location (White Water), and *Rhododendron* in another (Dry Sea Plain).

Fruitbodies of *R. rubri-attenuipes* are among the most popular *Ramaria* taxa sold in the Lijiang markets, attesting to their edibility.

When collected, these specimens resembled *R. sanguinipes*. Further examination showed the branches to be pale yellow to cream colored, and the apices to be concolorous or slighly brighter yellow. The stipe base was conspicuously stained deep maroon. Such fruitbody characters, together with long spores and lack of clamp connections, leads one to *R. xanthosperma* (Pk.) Corner. Spore measurements of that species taken by Petersen and Olexia (1967) and Petersen (1986) are very similar to those above (11.2—14.4×3.6—5.0 μm; **E** = 2.38—3.30; $\mathbf{E}^m$ = 2.86; $\mathbf{L}^m$ = 12.67 μm), with spore width somewhat narrower. Basidial length is also discrepant, but We ara not confident of this character as definitive. Most important, however, is the linear fruitbody stature with attenuate stipe in *R. rubri-attenuipes*, and habit under *Abies* and *Picea*. *Ramaria xanthosperma* fruitbodies exhibit a bluntly rounded base and habit under *Tsuga* in eastern North America. The two are clearly distinct.

Specimens examined: China, Yunnan Province, Lijiang Prefecture, Black Water River Gorge, (玉龙山，黑白水) 55 km N of Lijiang, 8. ix. 86, coll. M. Zang, no. 47268, (TENN, HKAS); Lijiang Pref., White Water, 50 km N Lijiang, 7. ix. 86, coll. RHP, no. 47267 (Holotype TENN, isotype HKAS: 17855); Lijiang market, 2. ix. 86, no. 47280)TENN, HKAS); Lijiang Pref., Dry Sea Plain, 30 km NE Lijiang, 3.ix. 86, coll. Mr.Guo, no.47277 (TENN, HKAS).

14. 红肉丛枝瑚亮色变种

Ramaria rubricarnata var. **laeta** Petersen, var.nov. Fig. 21

Ut variete typica, sed: 1) color rami et ramuli pallida; et 2) sporae $\mathbf{L}^m$ = 10.2 μm.

Fruitbodies up to 10×7 cm, obovate in outline. Stipe up to 4×3 cm, single (cespitose in this specimen), tapering to narrowly rounded base, smooth, without abortive branchlets, minutely pruinose between substrate particles and between stipes, off-white, brunnescent at base, weakly watery-brunnescent upward; flesh

off-white, moist but not gelatinous or slippery, solid, not mottled. Major branches three, flattened, twisted, watery-brunnescent where handled, concolorous with stipe downward, pallid ochraceous salmon upward (between "ochraceous salmon" and "cinnamon buff"). Branches in 3—7 ranks, ascending, more or less terete, salmon to salmon-orange ("ochraceous salmon," "salmon orange"); flesh more pallid, brittle to brittle-fibrous; internodes diminishing gradually at maturity; axils rounded throughout. Apices cusped to minutely double-dichotomous, minutely digitate when mature, pastel gold to bright orange-yellow ("light orange yellow," "deep chrome"). Odor and taste faintly fabaceous.

Macrochemical reactions: SYR = quickly, strongly positive, quickly fading; IKI = positive on stipe flesh; GUA, ANO = strongly positive; FCL, ANW, PHN, PYR = positive; CRE, KOH = negative.

Stipe tramal hyphae 4—11 μm diam, hyaline, conspicuously clamped, thick-walled (wall up to 1 μm thick), tightly interwoven, not agglutinated or adherent; ampulliform clamps up to 12 μm broad, not unusually thick-walled, with delicate stalactititiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3—13 μm diam, hyaline, conspicuously clamped, thin-walled, strictly parallel, short-celled, more inflated inward, tightly packed, not agglutniated to adherent; ampulliform clamps and gloeoplerous hyphae not observed. Subhymenium extensive; hyphae 1.5—2.5 μm diam, clamped, tightly interwoven. Hymenium thickening; basidia 50—65 × 9—10μm, clavate, clamped; contents homogeneous distally, granular proximally; sterigmata 4, very slender, straight.

Spores (Fig. 21) 8.3—11.9 × 4.0—4.7 μm (E = 1.92—2.67; E^m = 2.30; L^m = 10.17 μm), ellipsoid to rhomboidal, flattened adaxially, inconspicuously roughened in profile; contents with 1—3 dark inclusions, subrefringent; wall up to 0.2 μm thick; hilar appendix gradual, not prominent; ornamentation of small, randomly scattered flat warts.

Commentary: Superficially, fruitbodies of the collection cited below appear quite similar to those of *R. formosa* (q. v.). The two share basic salmon/yellow color pattern, somewhat stout, cespitose stipe, and brunnescent reactions. They differ in the following ways: *R. formosa* exhibits duller colors, stronger brunnescent reaction, longer basidia, inamyloid stipe flesh and longer spores (10.7—15.5 × 5.6—6.7 μm; L^m = 12.2 μm).

Conversely, this Chinese collection seems quite similar to *R. flava* var. *aurea* (Coker) Petersen (1982). Spore measuremnts are quite close (for the type specimen of *R. flava* var. *aurea* 8.3—11.5 (—12.6) × 3.3—4.1 μm; E^m = 2.66; L^m = 9.95 μm), basidia are short (50—55 × 7—8.5 μm for *R. flava* var. *aurea*) and fruitbody stature is similar. Branch color is more muted ("orange buff" to "ochraceous

buff") as is the color of the apices (concolorous with upper branches with a hint of chrome, *teste* Coker). Because We have no records on stipe flesh amyloidity and other macrochemical reactions, We prefer to keep the Chinese material separate.

More similar, however, is *R. rubricarnata* Marr and Stuntz (1973). It is characterized by: 1) pallid fleshy-yellow branches and yellow apices, with branch flesh salmon colored; 2) amyloid flesh and macrochemical reactivity; 3) clamped, short basidia; and 4) spores 9—11.2×3.6—4.7 μm (E^m=2.47; L^m=9.89 μm -my measurements). More recently (Petersen and Scates, 1989), additional varieties of *R. rubricarnata* have been described/Varieties *verna* and *elongata* are vernal fruiters in western North America. Separating all varieties from the Chinese collection is fruitbody coloration, which is considerably more muted, especially in the vernal varieties. The authors consider the varieties of *R. rubricarnata* and the Chinese collection to be conspecific, but not contaxic.

The specimen cited below reportedly fruited under *Pinus yunnanensis*, and is presumed edible.

Specimen examined: Yunnan, Er Yuan Pref., San Ying village market, (洱源,三阳村) 27. viii. 86, no. 47292 (holotype, TENN; isotype, HKAS).

(to be continued)